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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/581,441

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Yasuhiko Kasama

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YOUNG & THOMPSON

209 Madison Street

Suite 500

ALEXANDRIA, VA 22314

EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT

PAPER NUMBER

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/581,441	<b>Applicant(s)</b> KASAMA ET AL.	
	<b>Examiner</b> RAKESH K. DHINGRA	<b>Art Unit</b> 1792	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 June 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 12-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 12-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06/06</u>   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Information Disclosure Statement***

The information disclosure statement filed 6/02/06 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered. In this case no copy of any of the seven documents listed in the IDS under “Foreign Patent Documents” (5 documents), and “Other Documents” (2 documents) has been supplied.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 12, 16, 18, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Ahn et al (US 6,454,912), Keller (US 2004/0112543) and Hama et al (US 5,525,159).**

Regarding Claims 12, 16, 22: Gruen et al teach a deposition apparatus 10 comprising plasma generating means including a plasma generating chamber, a microwave generator 23 and a pair of coils located around the plasma generation chamber. Gruen et al further teach means for introducing precursors (fullerene) comprising of a sublimation oven 14 with a gas introducing pipe (e.g. Figs 1A, 1B and col. 2, line 50 to col. 4, line 5).

Further, applicant has invoked 35 USC 112, 6<sup>th</sup> Paragraph in respect of following claim limitations:

“means for generating high electron temperature plasma”, for which the disclosed structure is – plasma generating chamber 2 made from quartz having a plasma gas introducing port 6, microwave generator 5, a pair of coils 71, 72 located around external wall of the plasma generating chamber 2 and a four phase control helical antenna 8 wound around a gap between the coils 71, 72” {Figs. 1, 2 and Para. 0026};

“means for introducing fullerene” for which the disclosed structure is –a fullerene sublimation oven 9 with a fullerene introducing pipe 10 (Fig. 2 and paragraphs 0032, 0039).

The apparatus of Gruen et al teach all limitations of the claim in terms of the structure disclosed by the applicant, but do not teach the plasma generating chamber made from quartz and having a plasma gas introduction port, and a four phase helical antenna wound around a gap between the coils, and a precursor gas (fullerene) introducing pipe.

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However, quartz as the material for plasma generating chamber and having a plasma gas introduction port, and a precursor gas introducing pipe attached with the means for introducing fullerene are known in the art as per reference cited hereunder.

Ahn et al teach a plasma deposition apparatus comprising a quartz plasma generating chamber 126, a pair of coils 134, 136 (first and second magnetic coils 134, 136) disposed externally to the plasma generating chamber, and a plasma gas introducing port 128 (e.g. Fig. 1 and col. 3, line 20 to col. 5, line 68).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a quartz plasma generation chamber with plasma gas introduction port as taught by Ahn et al in the apparatus of Gruen et al to as known parts required to generate plasma in plasma deposition apparatus.

Gruen et al in view of Ahn et al do not teach a four phase helical antenna wound around a gap between the coils.

Keller et al teach a plasma apparatus comprising a plasma generation chamber and including a plurality of antenna elements 51A, 51B, 61A, 61B and a delay line (another antenna) 17 that provides phase difference between the plurality of antennas 51, 61 so as to obtain a uniform plasma with increased plasma density (e.g. Figs. 2, 3, 4 and para. 0032, 0036-0048). Keller also teach delay line 17/17' that provides phase difference of 180 degrees between coils 61A, 61B can be of any shape and its location can be selected as per process limitations. It would be obvious to provide an additional antenna with the coils in the apparatus of Gruen et al in view of Ahn et al to obtain increased plasma density coupled with improved uniformity.

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Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide an additional antenna with the coils in the apparatus of Gruen et al in view of Ahn et al as taught by Keller et al to obtain increased plasma density coupled with improved uniformity.

Gruen et al in view of Ahn et al and Keller do not teach the antenna is a four phased helical antenna.

Hama et al teach a plasma deposition apparatus comprising a plasma generation chamber with a four phase RF antenna including four coils 118 such that the electromagnetic fields generated by the four coils interfere less with each other and improve plasma uniformity. Hama et al also teach the coils may have spiral (helical shape) {e.g. Figs. 1, 9 and col. 8, line 65 to col. 9, line 35). It would be obvious to use a four phase antenna in the apparatus of Gruen et al in view of Ahn et al and Keller to minimize interference between the plurality of coils and obtain improved plasma uniformity.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a four phased helical antenna as taught by Hama et al in between the coil pairs in the apparatus of Gruen et al in view of Ahn et al and Keller et al to obtain less interference between the electromagnetic fields generated by the coil pairs and improve process uniformity.

Regarding Claim 18: Gruen et al in view of Ahn et al, Keller and Hama et al teach all limitations of the claim (as already explained above under claims 12, 14, 16) including plasma gas introducing means 128 (Ahn et al), a microwave generator 23 (Gruen et al), coil pairs 134, 136 (Ahn et al) and a four phased helical antenna 118 (Hama et al).

Further, claim limitations pertaining to manufacturing a fullerene derivative, introducing fullerene into plasma, electron energy at 15-50eV in order to generate a positive monovalent ion, and

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where a fullerene derivative produced as a result of reaction between the fullerene ion and  $M^+$ , are intended use/functional limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

**Claims 13, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Ahn et al (US 6,454,912), Keller (US 2004/0112543), Hama et al (US 5,525,159) and Dearnaley (US 5,393,572).**

Regarding Claims 13, 17: Gruen et al in view of Ahn et al, Keller, and Hama et al teach all limitations of the claim (as already explained above under claim 12) including plasma generating means, fullerene introducing means, but do not explicitly teach the fullerene ejected by the fullerene introducing means is allowed to impinge onto the deposition substrate so that  $M^+$  and fullerene react with each other to produce a fullerene deposit on the deposition substrate.

Dearnaley teach a deposition apparatus where a fullerene stream 25 is directed towards a substrate 22 so that the same reacts with an ion beam to produce a DLC coating on the substrate (e.g. Fig. 1 and col. 3, lines 40-55).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the gas introducing means that directs the gas towards a substrate as taught by Dearnaley in the apparatus of Gruen et al in view of Ahn et al, Keller, and Hama et al to enable control the deposited film properties.

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Further, claim limitations “M+ and fullerene react with each other to produce a fullerene deposit on the deposition substrate” is an intended use/functional limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Regarding Claim 19: Gruen et al in view of Ahn et al, Keller, Hama et al and Dearnaley teach all limitations of the claim (as already explained above under claims 12, 14, 16) including plasma gas introducing means 128 (Ahn et al), a microwave generator 23 (Gruen et al), coil pairs 134, 136 (Ahn et al) and a four phased helical antenna 118 (Hama et al).

Further, claim limitation “which prohibits dispersion of the positive ions produced” is an intended use/functional limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

**Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Claims 12, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in**



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**view of Ahn et al (US 6,454,912), Keller (US 2004/0112543) and Hama et al (US 5,525,159) as applied to claims 12, 16, 18, 22 and further in view of Delaunay et al (US 2004/0011291).**

Regarding Claim 14: Gruen et al in view of Ahn et al, Keller et al and Hama et al teach all limitations of the claim including a pair of coils 134, 136 but do not teach the coils generate a magnetic mirror which prohibits the dispersion of positive ions produced.

Delaunay et al teach an ECR plasma apparatus for processing a substrate 2 and comprising a plasma chamber, a plasma gas inlet 12, and magnetic coils 21, 22, 23 for forming a magnetic mirror that enables dissociation of the plasma gas to produce species that are deposited on the substrate (e.g. Fig. 2 and para. 0132-0155).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the pair of coils that form a magnetic mirror as taught by Delaunay et al in the apparatus of Gruen et al in view of Ahn et al, Keller et al and Hama et al to enable produce species at low pressure that are deposited on the substrate.

Further, claim limitation “which prohibits the dispersion of positive ions produced” is an intended use limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

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**Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Claims 12, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Ahn et al (US 6,454,912), Keller (US 2004/0112543), Hama et al (US 5,525,159) and Dearnaley 9US 5,393,572) as applied to claims 13, 17, 19 and further in view of Delaunay et al (US 2004/0011291).**

Regarding Claim 14: Gruen et al in view of Ahn et al, Keller et al, Hama et al and Dearnaley teach all limitations of the claim including a pair of coils 134, 136 but do not teach the coils generate a magnetic mirror which prohibits the dispersion of positive ions produced.

Delaunay et al teach an ECR plasma apparatus for processing a substrate 2 and comprising a plasma chamber, a plasma gas inlet 12, and magnetic coils 21, 22, 23 for forming a magnetic mirror that enables dissociation of the plasma gas to produce species that are deposited on the substrate (e.g. Fig. 2 and para. 0132-0155).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the pair of coils that form a magnetic mirror as taught by Delaunay et al in the apparatus of Gruen et al in view of Ahn et al, Keller et al, Hama et al and Dearnaley to enable produce species at a low pressure that are deposited on the substrate.

Further, claim limitation “which prohibits the dispersion of positive ions produced” is an intended use limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

**Claims 20, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Ahn et al (US 6,454,912), Keller (US 2004/0112543) and Hama et al (US 5,525,159) as applied to claim 12, 16, 18, 22 and further in view of Sano et al (US 6,372,304)**

Regarding Claims 20, 21: Gruen et al in view of Ahn et al, Keller and Hama et al teach all limitations of the claim including a pair of coils and grid electrodes 118, 120, but do not explicitly teach electron energy control means for controlling the energy of electrons in a plasma to be in the range of 1 to 10 eV, the electron energy control means being located downstream of the high electron temperature plasma generating means in terms of the flow of plasma.

Further, applicant has invoked 35 USC 112, 6<sup>th</sup> Paragraph in respect of following claim limitations:

“electron energy control means”, for which the disclosed structure is – a control electrode 18 which is applied a variable potential” {Figs. 1, 2 and Para. 0025};

Sano et al teach a deposition apparatus comprising a plasma generation chamber 1, magnetic coils 2 placed externally around the chamber 1, a processing chamber 4 and a control electrode 14 (electron energy control means) located downstream of the plasma generating chamber, which is connected to a variable DC power supply (-50V to + 50 V) that enables to control the energy of electrons reaching the plasma processing chamber 4 (e.g. Fig. 1 and col. 4, line 37 to col. 5, line 23).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide electron energy controlling means down stream of the plasma generating means

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as taught by Sano et al in the apparatus of Gruen et al in view of Ahn et al, Keller and Hama et al to enable control electron energy reaching the plasma processing chamber.

Further, claim limitation regarding electron energy to be in the range of 1 to 10eV is a functional limitation, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12).

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 12, 18, 20, 21 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5, 10 of copending Application No. 11/659,201 (US 2009/0022648) in view of Ahn et al (US 6,454,912), Keller (US 2004/0112543) and Hama et al (US 5,525,159).

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Claims 1-5, 10 of the copending application teach all limitations of claims 12, 18, 20, 21 of the instant application including plasma generating chamber, fullerene introducing means, magnetic field generating pair of coils, but do not teach the plasma generating chamber made from quartz, and a four phased helical antenna located between the pair of magnetic field generating coils.

Ahn et al teach a plasma deposition apparatus comprising a quartz plasma generating chamber 126, a pair of coils 134, 136 (first and second magnetic coils 134, 136) disposed externally to the plasma generating chamber, and a plasma gas introducing port 128 (e.g. Fig. 1 and col. 3, line 20 to col. 5, line 68).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a quartz plasma generation chamber with plasma gas introduction port as taught by Ahn et al in the apparatus of claims 1-5, 10 of the copending application as known parts required in plasma generating chamber of plasma deposition apparatus.

Claims 1-5, 10 of the copending application in view of Ahn et al do not teach a four phase helical antenna wound around a gap between the coils.

Keller et al teach a plasma apparatus comprising a plasma generation chamber and including a plurality of antenna elements 51A, 51B, 61A, 61B and a delay line (another antenna) 17 that provides phase difference between the plurality of antennas 51, 61 so as to obtain a uniform plasma with increased plasma density (e.g. Figs. 2, 3, 4 and para. 0032, 0036-0048). It would be obvious to provide an additional antenna with the coils in the apparatus of Gruen et al in view of Ahn et al to obtain increased plasma density coupled with improved uniformity.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide an additional antenna with the coils in the apparatus of Claims 1-5, 10 of the

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compending application in view of Ahn et al as taught by Keller et al to obtain increased plasma density coupled with improved uniformity.

Claims 1-5, 10 of the compending application in view of Ahn et al and Keller do not teach the antenna is a four phased helical antenna.

Hama et al teach a plasma deposition apparatus comprising a plasma generation chamber with a four phase RF antenna including four coils 118 such that the electromagnetic fields generated by the four coils interfere less with each other and improve plasma uniformity. Hama et al also teach the coils may have spiral (helical shape) {e.g. Figs. 1, 9 and col. 8, line 65 to col. 9, line 35). It would be obvious to

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a four phased helical antenna as taught by Hama et al in between the coil pairs in the apparatus of Claims 1-5, 10 of the compending application in view of Ahn et al and Keller to obtain less interference between the electromagnetic fields generated by the coil pairs and improve process uniformity.

This is a provisional obviousness-type double patenting rejection.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/  
Examiner, Art Unit 1792

/K. M./  
Primary Examiner, Art Unit 1792